Saskatchewan
Environment

Assessment of Fish Stocks in Deschambault Lake 2004

Fish and Wildlife Technical Report 2007-2

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ASSESSMENT OF FISH STOCKS IN DESCHAMBAULT LAKE, 2004

Fish and Wildlife Technical Report 2007-2

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Introduction

Deschambault Lake is a large multi-basin lake in north-central Saskatchewan that supports commercial, sport, and domestic fisheries (Figure 1). The popularity of this lake for sport fishers has been well documented over the years, as has the commercial fishery (Johnson 1967, 1970; Naftel, 1972; Wallace 1981; Liaw, 1993). Uses of the fishery resource have changed little since the previous survey in. Four licenced outfitters currently operate on the lake, with one of them running the provincial recreational site on the South East Arm. A commercial fishery has existed on the lake since the early 1920's, and has two distinct quotas, one for Ballantyne Bay and one for the northern Precambrian area of the lake. Since 1991, the former northern hamlet of Deschambault Lake has received reserve status.

The lake has two distinct basins, which are separated by a channel running north south. The southern basin (Ballantyne Bay) is large and circular in shape with a relatively uniform depth. The northern area of the lake lies within Precambrian Shield sedimentary rock and is much less uniform in its attributes. For administrative purposes, this area is referred to as the Precambrian area. It has an irregular shoreline with many bays and is much deeper in the open water areas. The portion of the channel north of 54° 48' that connects the two basins has been considered to be part of the Precambrian area in the past despite its similarities to Ballantyne Bay in terms of morphometry and water chemistry. Johnson (1967) reported that the distinctions between the two basins were made due to differences in grades of whitefish in the commercial fishery (i.e. *Triaenophorus crassus* cyst infection rates), with the Precambrian area being "A" grade while Ballantyne Bay was "B" grade. The line that separates the two commercial quotas is still used today, despite a shift in focus of the commercial fishery from whitefish to walleye (Figure 1).

Ballantyne Bay has an area of 27,100 hectares, with a mean depth of 5.8 m and a maximum depth of 10.2 m (Liaw 1993). The Precambrian area is comprised of East Bay

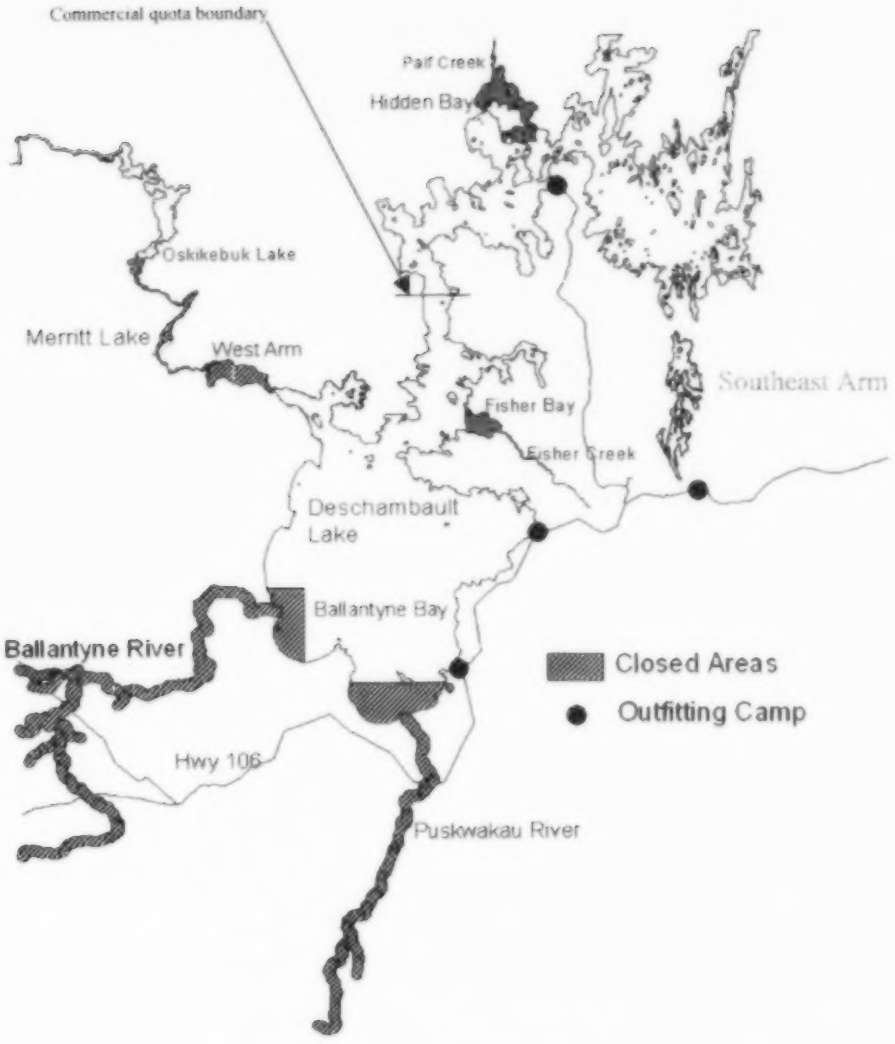

Figure 1. Map of Deschambault Lake and area showing commercial quota boundary line, spawning closures and location of outfitters on the lake. Ballantyne Bay is to the south of the line while the Precambrian area is to the north and east.

and the Deschambault Channel. The Channel has an area of 12,500 hectares, a mean depth of 5.3 m and a maximum depth of 15.7 m while East Bay is 14,200 hectares with a mean depth of 7.6 m and a maximum of 22.4 m (Liaw, 1993).

Several management actions have been implemented on the lake and its tributaries, mainly in response to heavy exploitation by the sport fishery. Spawning closures are in place on many of the key spawning rivers to protect the stock from overharvest during this critical period when they are more susceptible to anglers. The Puskwakau River and the river mouth in Ballantyne Bay have been closed for fishing during the spring since 1980. Other spawning closures have been implemented over the years including Ballantyne River, Fisher Creek, Palf Creek and the Oskikebuk River (Figure 1). These closures affect all users of the resource, and are supported by a Band Council Resolution for their effect on sustenance fishers.

A test net survey was initiated in 2004 to assess changes in the fishery at the request of the local Co Management Board as there is concern regarding the walleye stocks on the lake. The study duplicated the one done in 1991 to best determine changes in abundance and biological indicators of fish population status.

Methods

In order to obtain trend data on the fishery on Deschambault Lake, similar procedures for sampling large bodied fish were used in 2004 as in 1991. Where possible, the identical net set location was determined from 1991 field notes and replicated in the current study. Due to weather conditions, one net set (#19) was not set. Standard gang gill nets consisting of 38, 50, 76, 102, 127 and 140 mm (1.5, 2, 3, 4, 5, and 5.5-inch) stretch measure multifilament panels totaling 274 metres were used. Nets were fished 18-24 hours.

Game fish captured were examined for total and fork lengths, weight, sex and state of maturity, as well as for stomach contents. Otoliths were taken from walleye and

Figure 2. Location of standard gang net sets and limnology stations. Net sets are numbered and limnology stations are represented by red dots.

cleithra from northern pike for age determination. No ageing samples were taken from whitefish. Other species were enumerated and measured for fork length and weight only.

North-South Consultants Inc from Winnipeg MB performed age analysis on a subsample of structures. One hundred fifty walleye otoliths and one hundred pike cleithra were aged. Subsample selection was performed using a length-age key with 2 cm length bins for walleye and 5 cm bins for pike. The ageing results were then extrapolated to the entire sample according to commercial fishing area. Length at age was calculated for the entire sample by the equation:

Mean length at age = $(\sum fx)/(\sum f)$ (DeVries and Frie, 1996)

where f= number of fish at age f and x =the midpoint length of the bin.

Limnological measurements were taken at the four sites originally sampled in 1961 in order to update information on the lake and to determine if changes have occurred. Sampling occurred once in each of June, July and August to monitor seasonal changes at each site. Temperature and dissolved oxygen profiles were taken, as were water samples for standard chemical analyses (Appendix 1).

For the purposes of data analysis, the lake was divided into two distinct regions, Ballantyne Bay and the Precambrian Area. The dividing line for the commercial fisheries was used as the boundary for this analysis to determine localized changes in fish community indices based on the different pressures seen in each area. The data from 1991 was re-analyzed to reflect the dividing line.

Results

Limnology

Limnology measurements were taken at four sites in the lake in 2004 to correspond with those taken in previous years (Figure 2). Liaw (1993) reported a lack of a strong

thermocline in the East Bay and that oxygen depletion in this area was unlikely. This was not the case in 2004 where a thermocline began to establish in June between 4 and 6 metres, and continued to deepen into August to between 12 and 14 metres (Figure 3).

Dissolved oxygen profiles in East Bay (Station 4) indicate a degree of oxygen depletion in the lower 2-3 metres of the Bay (Figure 3). Oxygen concentrations stabilized by the August measurements, corresponding with the temperature stratification seen. Strong winds throughout the summer in 2004 did not have any effect on either the temperature or oxygen profiles in East Bay, indicating the stratification in this portion of the lake is strong and likely persists in each year.

Stratification did not occur at any of the other three limnology stations in Ballantyne Bay and the Channel (Figure 3). A weak thermocline was present in July at Station 1, however it was not present in August. This is most likely an anomaly as Ballantyne Bay is generally well mixed due to wind and wave action.

Secchi disc readings were taken at each of the four limnology stations in each of the three months (Appendix 1). Readings generally became shallower throughout the summer, reaching a minimum of 1.4 metres at Station 3 in the Channel. The results for stations 1-3 were similar, indicating little difference between the sites. Station 4 in East Bay was consistently deeper than the other sites, ranging from 2.7 m in June, to 3.5 in July, and then rising to 2.1 in August.

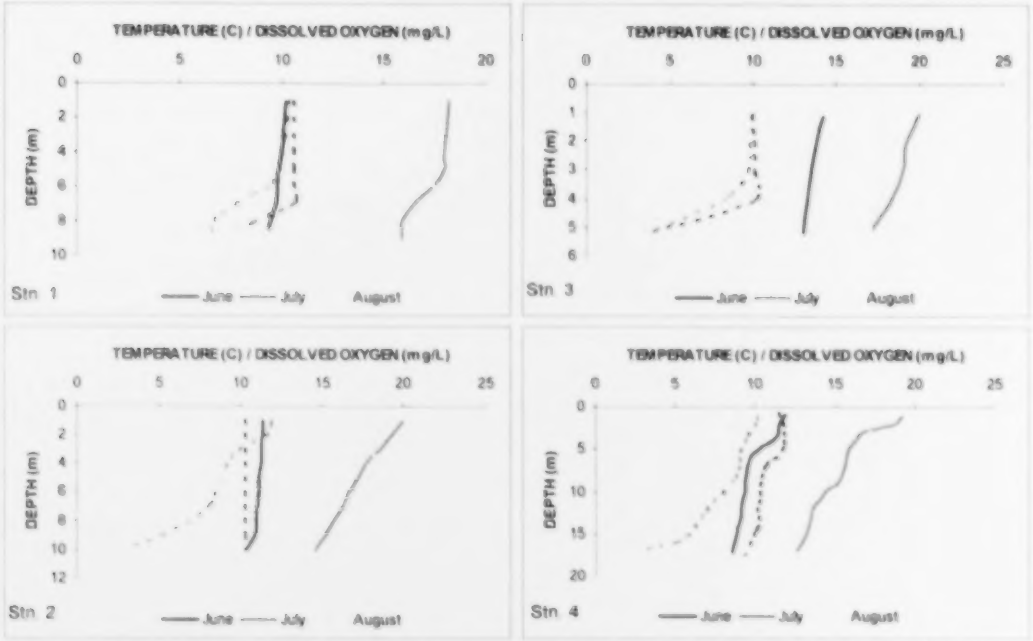

Figure 3. Temperature and dissolved oxygen profiles for Deschambault Lake. Solid lines represent temperature, dashed lines represent dissolved oxygen.

State of the Fish Stocks

Abundance

Changes in the catch composition are seen between the 1962 survey, the 1991 survey and the most recent one (Figure 4). A general trend can be seen in terms of relative abundance of the large bodied fish community in Deschambault Lake. The proportion of walleye in test nets has continually decreased, from a high of 31.5% of the total catch to the current level of 11.9%. Concurrently there has been an increase in the proportion of northern pike, as well as yellow perch and white sucker; while cisco has been decreasing. Shorthead redhorse, longnose sucker, burbot and whitefish have not been abundant in large numbers in any of the surveys done on the lake. It is not known if these changes in abundance are statistically significant, however, as the amount of netting may not have been adequate to detect a significant change. In addition trends may not be seen due to the small number of surveys done (3) and the amount of time between them.

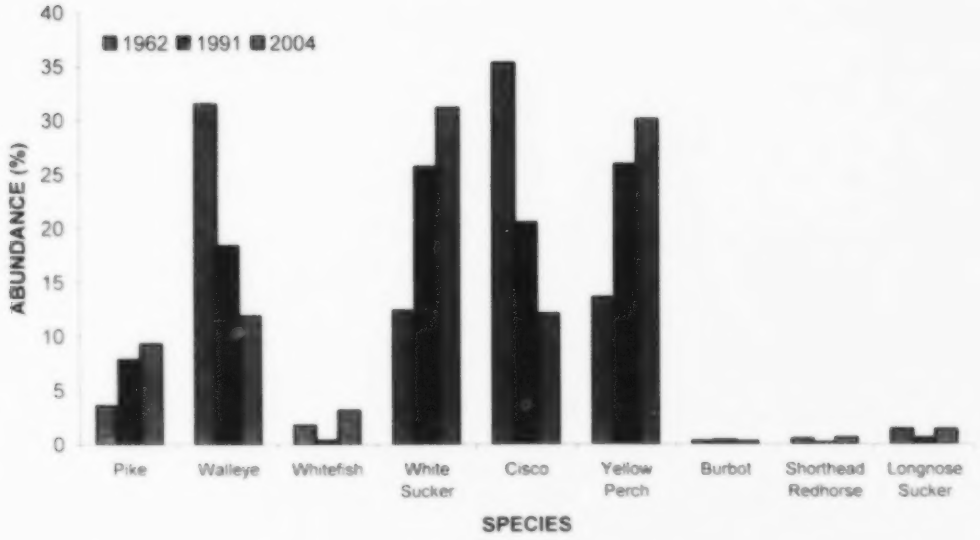

Figure 4. Relative abundance by species from standard gang gillnets, 1961-2004.

For the purpose of this analysis, net sets were grouped by their location relative to the commercial fishing areas to detect trends and changes. Because the exact net set locations from 1961 were not used in 1991, the data from 1961 is not broken down by commercial fishing area. Data from net set #19 in 1991 was not included in the following analysis, as this net was not set in 2004 due to bad weather. In the Ballantyne Bay area (including the southern portion of the channel), walleye abundance decreased slightly while northern pike abundance increased, similar to results seen for the entire lake (Figure 5). Almost no change in white sucker, cisco, or yellow perch abundance was seen. In the Precambrian area, decreases were seen in both walleye and northern pike, while whitefish abundance increased. White sucker and yellow perch abundance increased, while ciscoes decreased sharply.

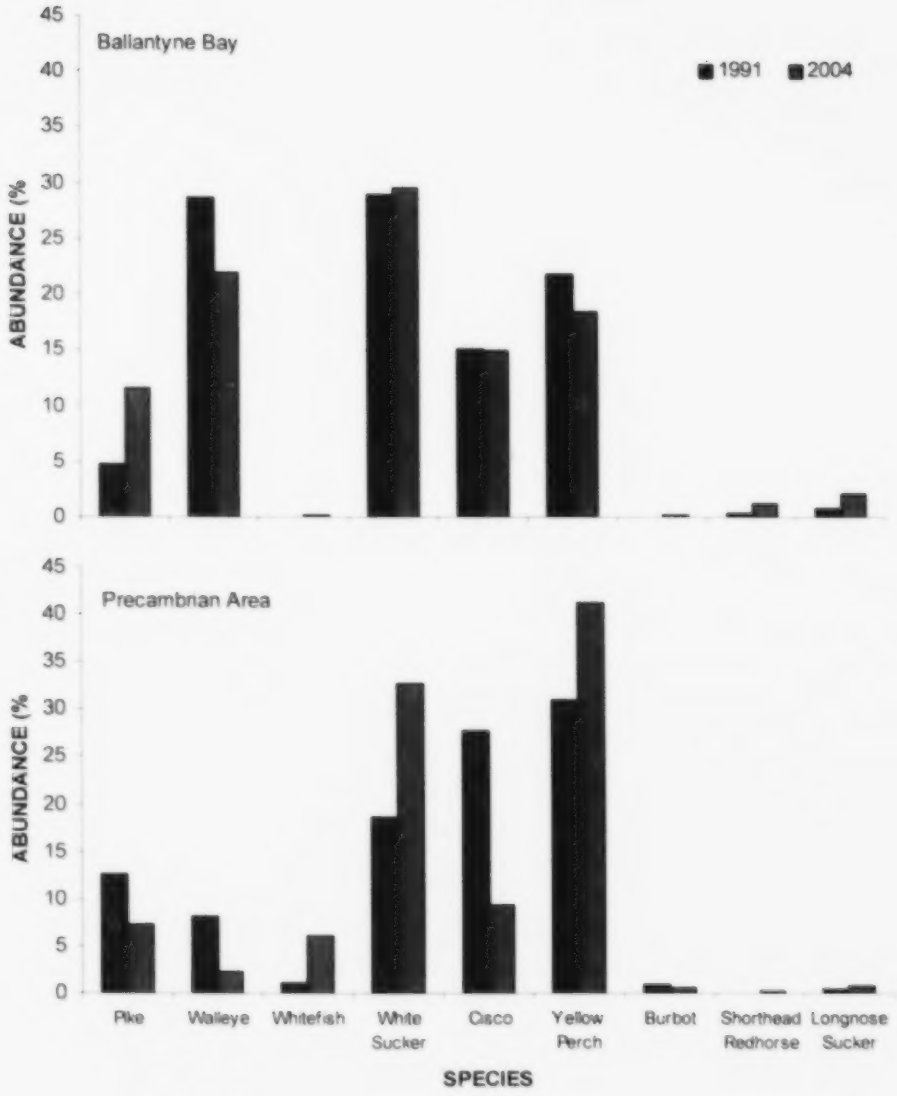

Figure 5. Relative abundance for Ballantyne Bay and the Precambrian area of Deschambault Lake, 1991-2004.

Walleye

As noted, the abundance of walleye in Deschambault Lake has decreased between each of the three surveys. Liaw (1993) indicated a gradient of decreasing walleye abundance from southwest to northeast in the lake, with Ballantyne Bay having the highest average

number of walleye per net set and East Bay having the fewest. This gradient is still present in the current study (Table 1). Of the ten walleye caught in the East Bay area eight were from the Southeast Arm (Figure 1), which may represent a distinct population given the separation between the South East Arm and the remainder of the lake at East Bay.

Table 1. Average number of walleye caught per net set in all survey years. Number in parentheses indicates the number of net sets.

	Ballantyne Bay	**The Channel**	**East Bay**
1962	118.1 (8)	79.8 (4)	17.2 (6)
1991	80.1 (7)	69.4 (5)	9.6 (8)
2004	44.0 (7)	33.6 (5)	1.25 (7)
All years	82.5 (22)	59.6 (14)	9.1 (21)

Liaw concluded that differences in walleye abundance in the various lake areas were due to differences in sampling area and depth rather than differences in sampling year. While no analysis has been done to prove this in the current survey, the duplication of effort to minimize sampling variance would most likely produce the same result.

Although there were no statistical differences in fork length between the walleye caught in the different commercial fishing areas, they were analyzed separately to determine localized effects of the different harvest pressures on the fish stocks. Walleye captured in 2004 ranged from 15.5 cm to 49.7 cm fork length (Figure 6). The 35-45 cm length classes dominated the catch in both areas, with almost 40% of the fish caught being in this range in each area. Few fish over 45 cm were captured, with none over 50 cm being caught in 2004 or 1991. Smaller fish in the 20-30 cm size class were not as well represented in the catch in 2004 as in 1991 in the Ballantyne Bay area. In both years, this size was poorly represented in the Deschambault Lake area. Mean length at capture increased slightly from 37.2 cm in 1991 to 37.7 cm in 2004 for Deschambault Lake and from 34.9 cm to 37.6 for Ballantyne Bay. This latter increase was largely due to the higher abundance of small fish in 1991 compared to 2004.

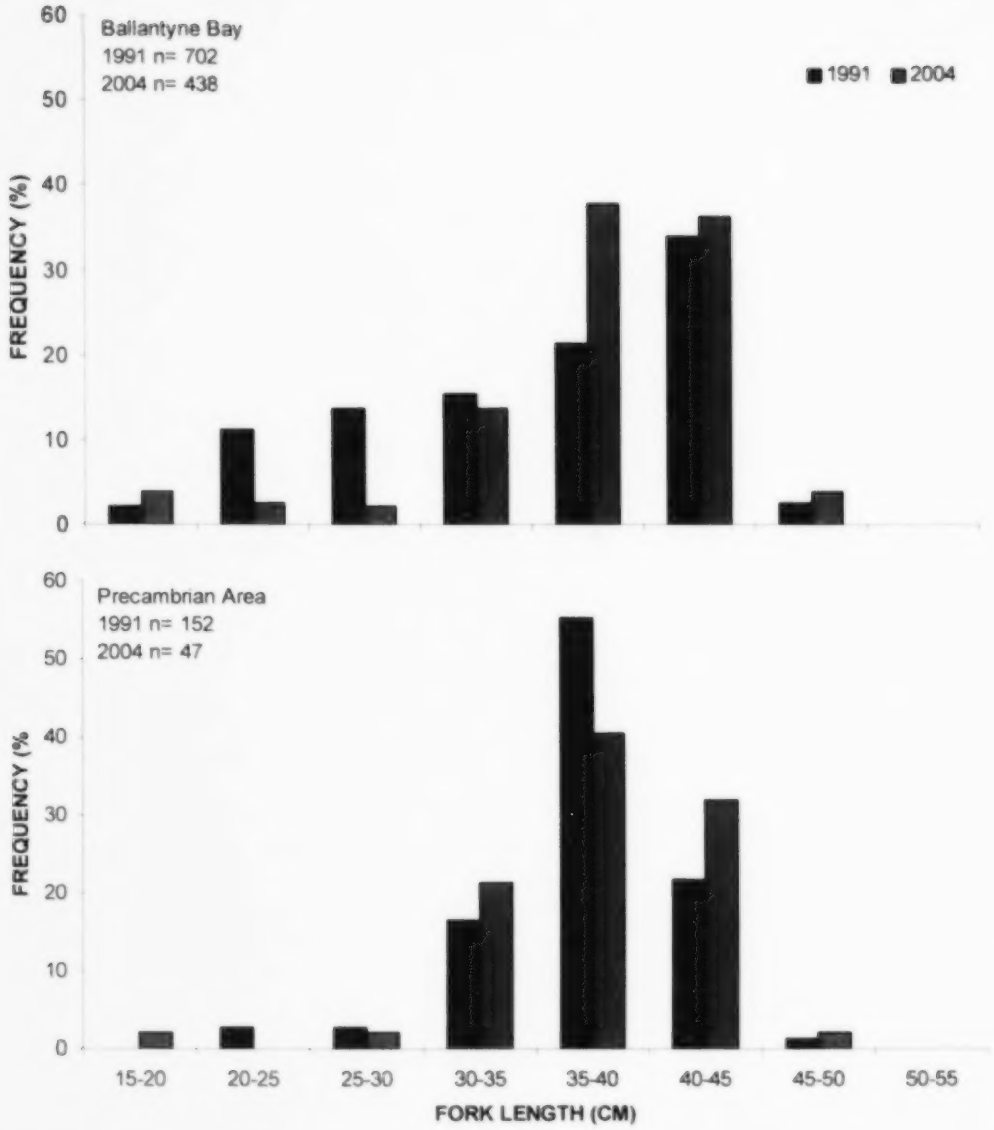

Figure 6. Fork length frequency for walleye from Ballantyne Bay and the Precambrian area of Deschambault Lake, 1991-2004.

A total of twelve age classes were caught in the 2004 survey, a decrease from the sixteen seen in 1991 (Figure 7). The catch displayed a relatively unimodal distribution, with age 6 and age 7 fish dominating the catch. One fish aged 14 and one aged 17 were caught in the Ballantyne Bay area. The catch in the Precambrian area was represented by only

seven year classes, whereas all twelve were caught in Ballantyne Bay. Age 6 fish dominated the catch in the northern area, while age 7 were most prevalent in Ballantyne Bay. In 1991, age five fish were most abundant in both areas of the lake. Mean age at capture in 2004 was 5.93 years for Ballantyne Bay, 5.51 for the Precambrian area, and 5.83 years for the lake overall.

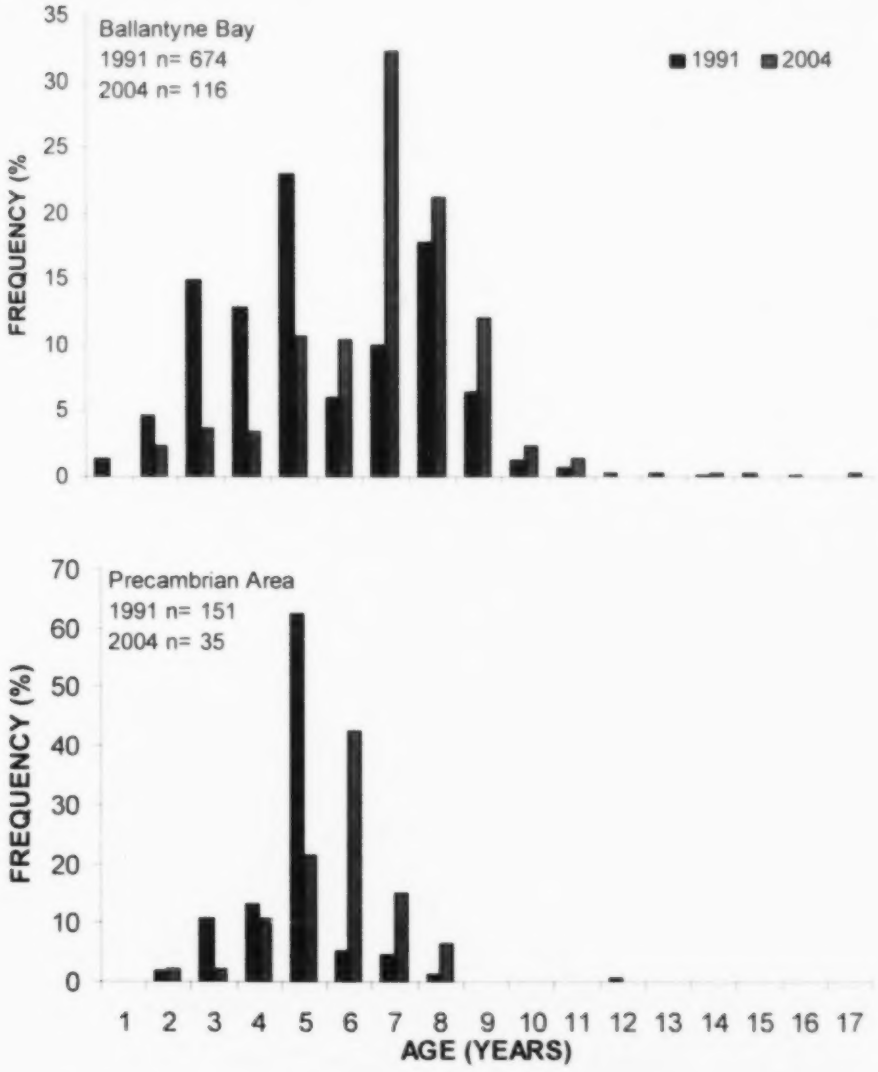

Figure 7. Age frequency for walleye from Ballantyne Bay and the Precambrian area of Deschambault Lake, 1991-2004.

Length – weight relationship for walleye have changed little from 1991 to the present study (Figure 8). There is no difference in length-weight curves between the two commercial fishing areas. This may be due to the majority of the walleye from the

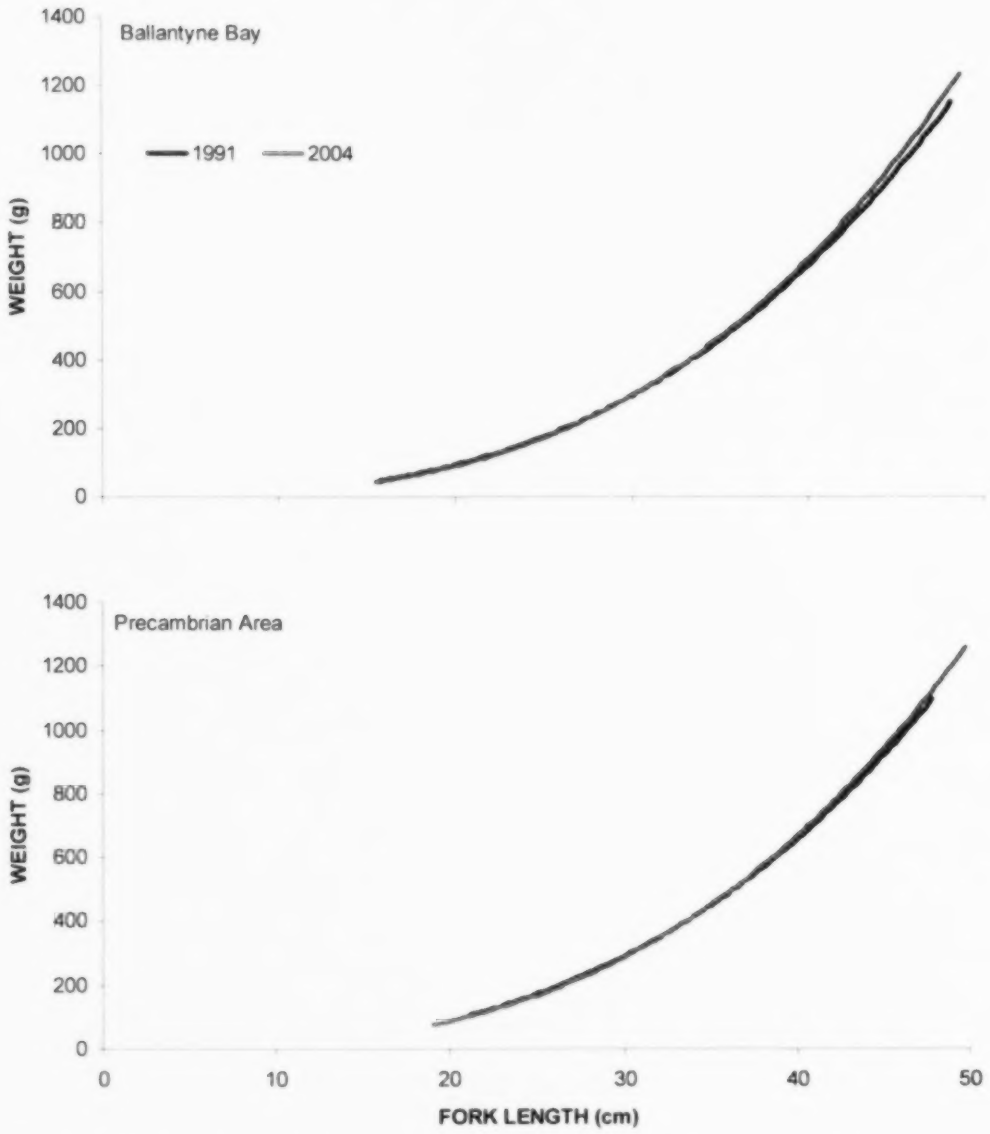

Figure 8. Length-weight relationship for walleye from Ballantyne Bay and the Precambrian area of Deschambault Lake, 1991-2004.

Precambrian area being caught in the northern portion of the Deschambault Channel. Increases in weight at length are associated with increased exploitation in percid populations (Spangler et al, 1977).

Average length at age for walleye from Deschambault Lake has changed little from the 1991 survey (Figure 9). Walleye from Ballantyne Bay in 2004 have slightly slower

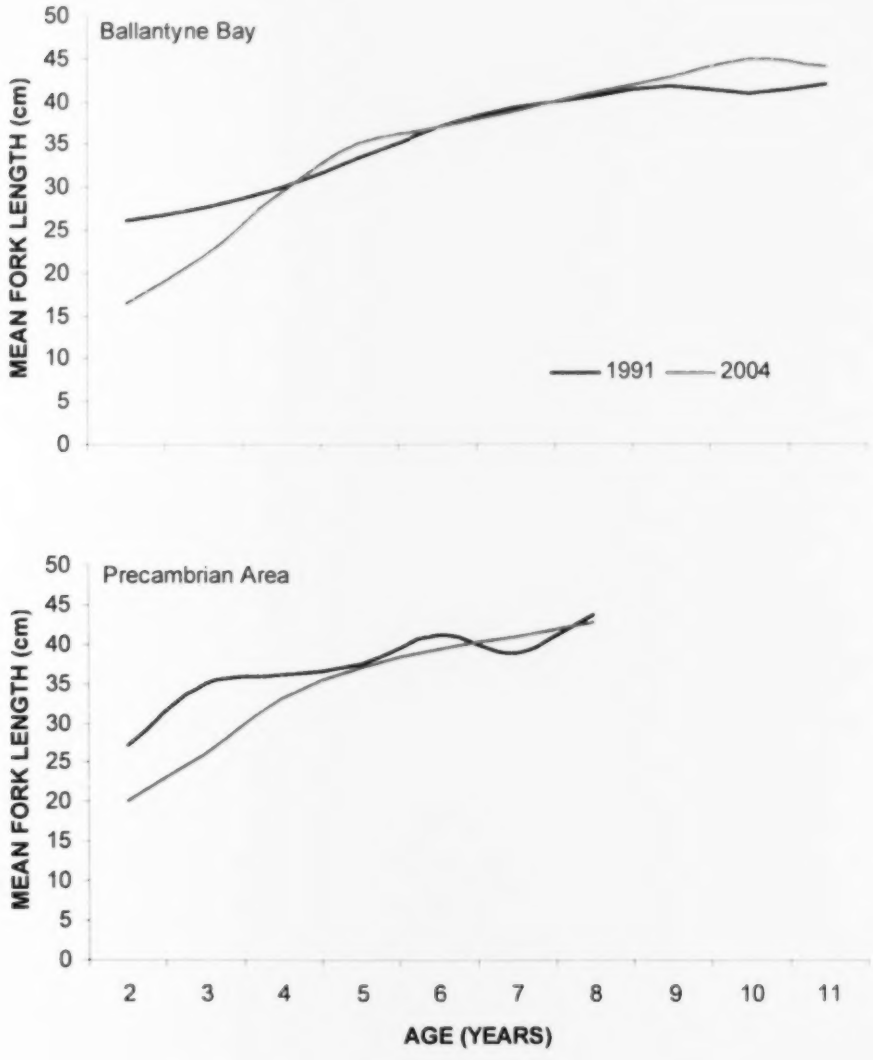

Figure 9. Length at age for walleye from Ballantyne Bay and the Precambrian area of Deschambault Lake, 1991-2004.

growth up to age 3, after which they grew faster than those from 1991 up till age 7 at which time growth was equal. A similar trend is seen in younger fish from the Precambrian Area, with age 2 and 3 fish growing slower in the current survey compared to 1991. After this point growth from both surveys was equal. Based on slower growth for only the younger fish in both areas of the lake, variations in weather conditions or forage availability may be responsible for this, and it would not represent a response to exploitation normally seen in percids.

Northern Pike

Relative abundance of northern pike in the whole lake has increased since the previous two surveys, from 3.6% in 1961/62 to 9.5% in 2004 (Figure 4). This increase was largely driven by results from the Ballantyne Bay area, as the Precambrian area has seen a decrease since the 1991 survey (Figure 5).

The number of pike per set increased from 18.7 in 1991 to 20.5 in 2004. The increase in the number of pike caught was greatest in Ballantyne Bay, with an increase from 12.6 fish per set in 1991 to 27.1 in 2004. The number of pike per set in the Precambrian area decreased from 21.9 in 1991 to 15.4 in 2004.

Fork length frequency of northern pike caught in Deschambault Lake has changed little between survey years (Figure 10). Mean fork length at capture in 1991 was 49.7 cm, and increased slightly to 50.2 cm in 2004 in the Ballantyne Bay area. Similar results were seen in the Precambrian area, increasing slightly from 48.9 cm in 1991 to 50.6 cm in 2004. In both survey years, pike in the 50-55 cm length range dominated the catch. In.

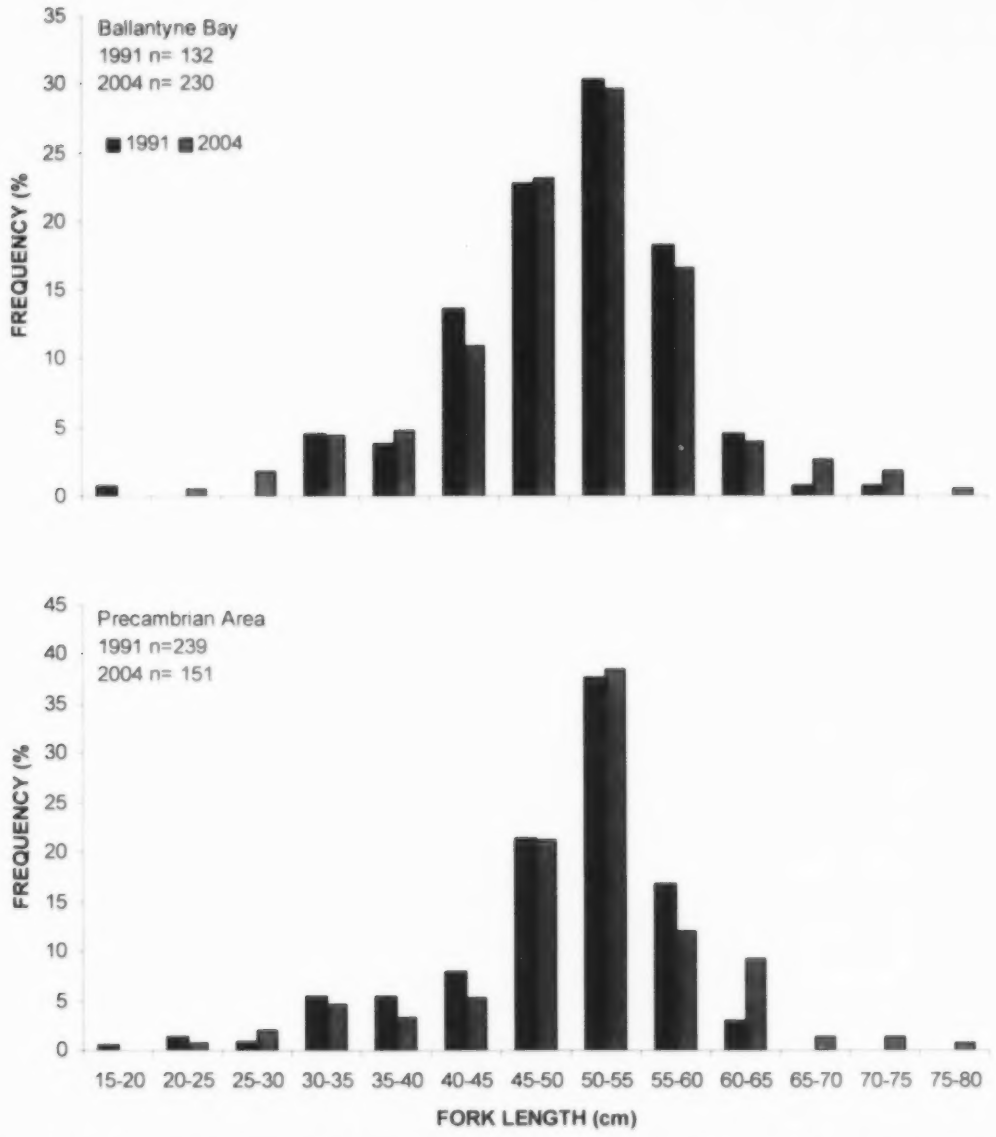

Figure 10. Length frequency for northern pike from Ballantyne Bay and the Precambrian area of Deschambault Lake, 1991-2004.

the latest survey, pike larger than 65 cm fork length were seen in greater numbers in both areas of the lake

Northern pike age structure appears to have shifted towards older individuals (Figure 11). It must be noted, however, that in the 1991 survey, scales were used to age pike whereas

cleithra were used in the current survey, which may result in differences in ageing. A total of ten years classes were seen in the 2004 survey compared to only eight in the 1991 survey. Mean age at capture was 5.22 years in 2004, an increase from 4.10 years in 1991.

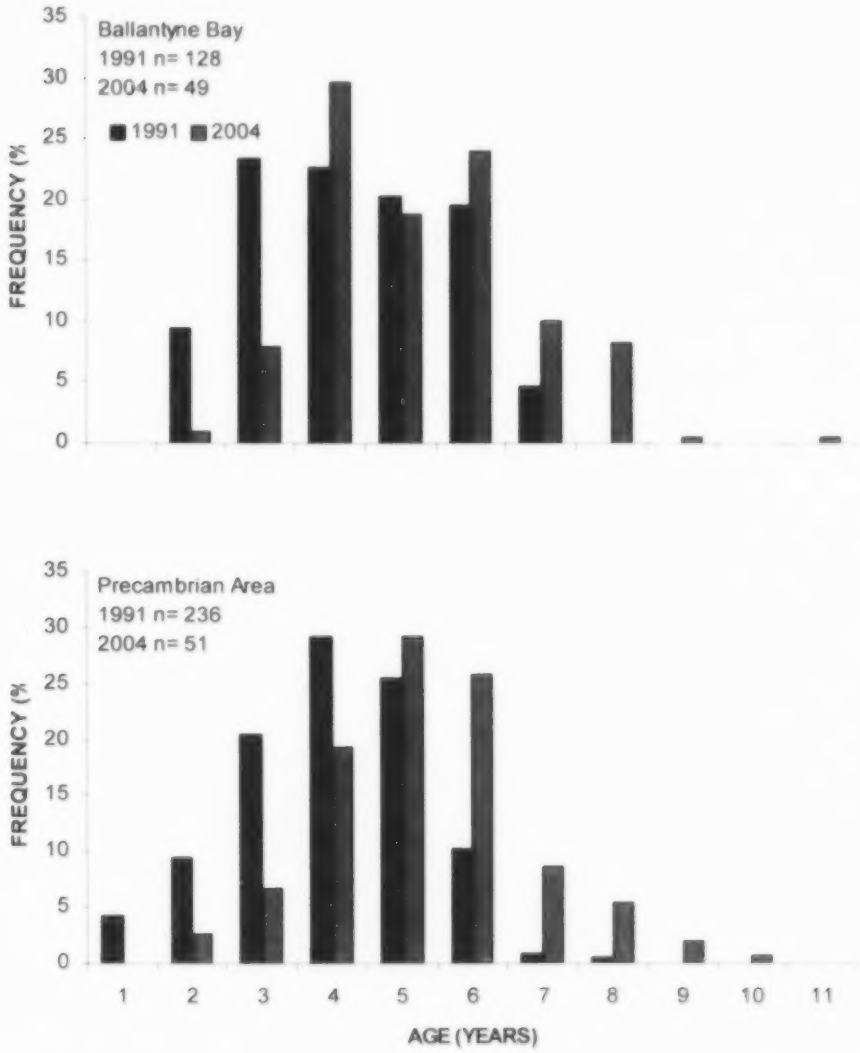

Figure 11. Age frequency for northern pike from Ballantyne Bay and Precambrian area of Deschambault Lake, 1991-2004.

Length-weight relationships for northern pike have not changed appreciably from the previous survey (Figure 12). Similar to walleye, growth rates between the two commercial fishing areas are similar.

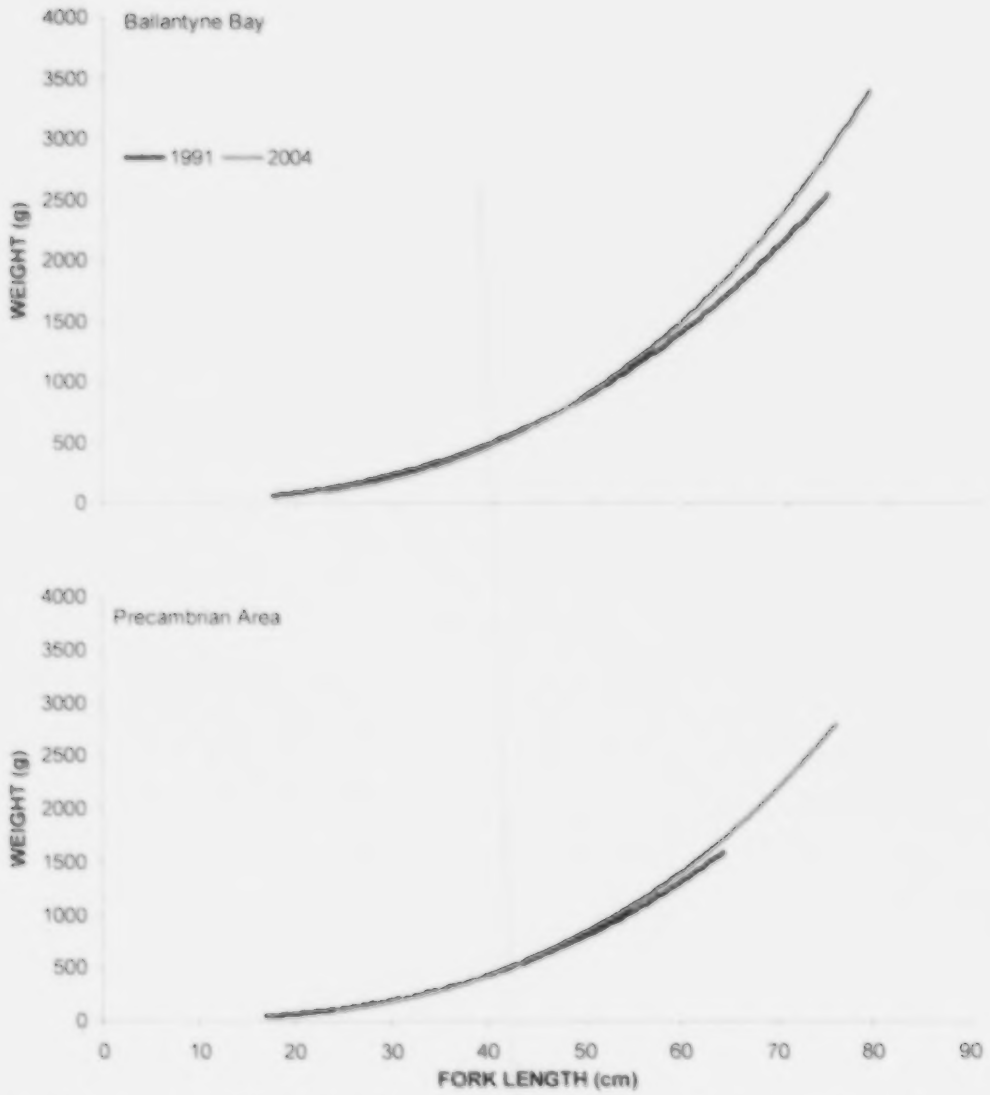

Figure 12 Length-weight relationships for northern pike from Ballantyne Bay and Precambrian Area of Deschambault Lake, 1991-2004.

Length at age for northern pike has changed since the 1991 survey, with a decrease in length for a given age being seen, especially in younger fish (Figure 13). This change was seen in both areas of the lake, while a comparison in growth between areas shows no differences. This difference may be a result of using scales for ageing northern pike in 1991 and cleithra in 2004.

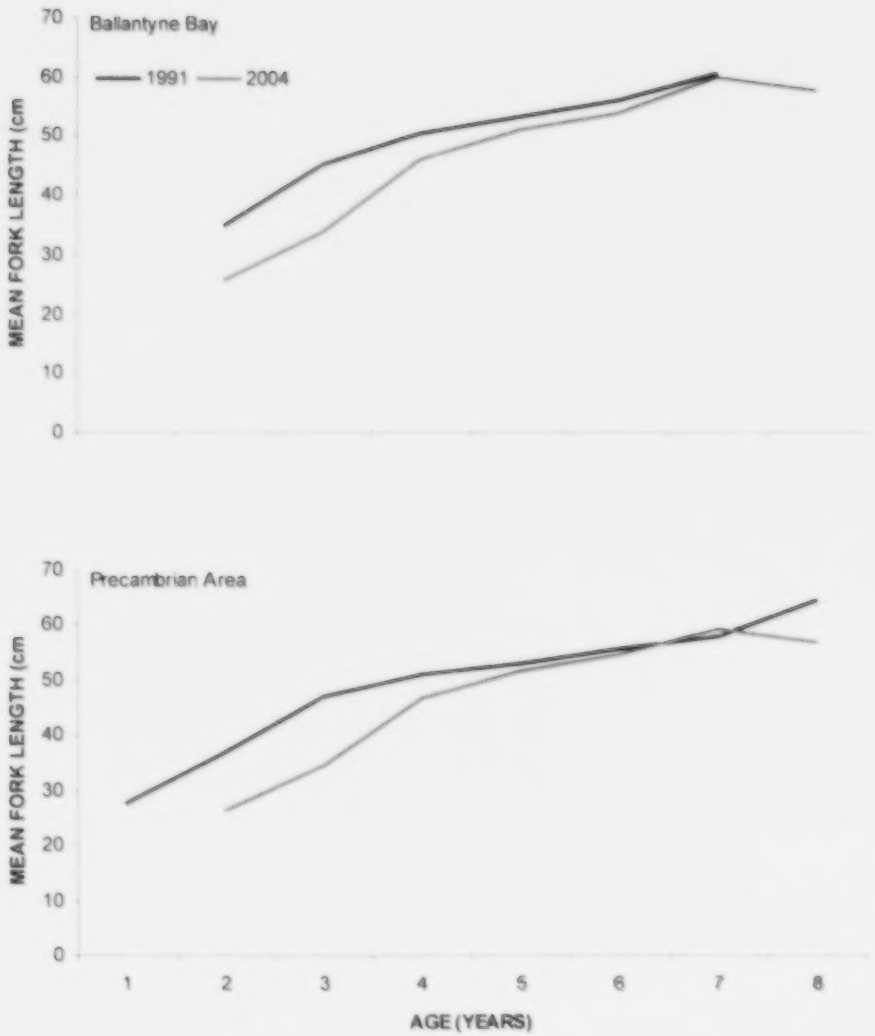

Figure 13. Length at age for northern pike from Ballantyne Bay and Precambrian area of Deschambault Lake, 1991-2004.

Lake Whitefish

The number of whitefish caught in the 2004 survey has increased substantially from the 1991 and 1962 surveys. A total of 129 whitefish were caught, compared to 20 and 68 respectively. Similar to 1991 results, whitefish catches in Ballantyne Bay in 2004 were lowest of the two areas, with only 2 of the 129 fish in the present survey being captured there.

Average size of whitefish captured in the current survey has decreased since the 1991 survey (Figure 14). This is largely due to a high catch of small whitefish (<20 cm fork length) in the Precambrian area. This may suggest that whitefish stocks in this area are showing signs of recovery after high exploitation in the late 1940's and early 1950's.

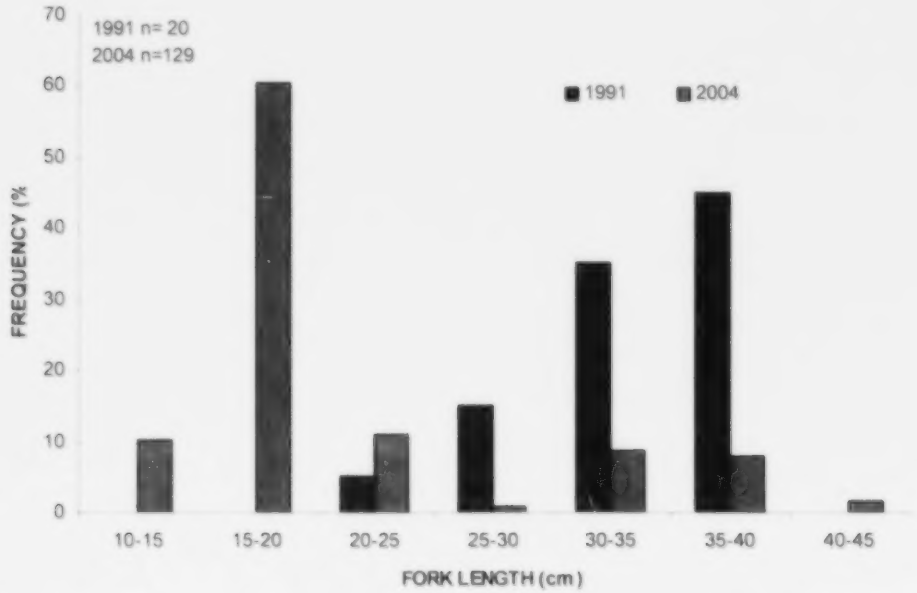

Figure 14. Fork length frequency for whitefish from Deschambault Lake, 1991-2004.

Cisco

Overall, numbers of cisco caught by test nets has continually declined since the initial survey in 1962. In the 2004 survey, 493 ciscoes were captured, compared with 1530 in 1962 and 968 in 1991. When analyzed by netting area, abundance in Ballantyne Bay has remained steady with 1991, whereas abundance in the Precambrian area has declined considerably.

In both 1991 and 2004, the average catch per net of cisco was almost equal for Ballantyne Bay and the Precambrian area of the lake, whereas in 1962 the catch in the Precambrian area was over six times that of Ballantyne Bay.

White Sucker

There was an increase in the total number of suckers caught in 2004 compared to 1991, as

well as the overall abundance of suckers in the catch (Figure 4). Abundance in Ballantyne Bay remained steady, while that in the Precambrian area increased. Average catch for the lake increased from 60.8 fish per set to 65.5 fish per set. This increase was largely driven by catches in the Precambrian area, which increased from 58.4 to 68.7 fish per set. Ballantyne Bay catches decreased from 65.1 to 60.0 fish per set. Sucker numbers in all areas are still well above those seen in the initial survey of 1962.

Yellow Perch

Similar to white sucker, yellow perch numbers have increased slightly since the previous survey, however, the increase was not as dramatic as that seen between 1962 and 1991. This is largely driven by increases in the Precambrian area, as abundance in Ballantyne Bay decreased slightly. Lake wide, perch catches increased from 61.2 to 64.7 fish per set.

Other Species

Longnose sucker, Shorthead redhorse, and burbot were all caught in the present survey, however not in any great numbers. The sucker species were most prevalent in the Ballantyne Bay area, whereas the burbot were most common in the Precambrian area.

Harvests

The Commercial Fishery

An extensive review of the history of the commercial fishery on Deschambault Lake is available in Liaw (1993) and does not bear repeating here. Since the time of that report, little has changed in terms of regulation of the fishery. Fishing still occurs during the summer based on an open competition quota format. Quotas were adjusted in the mid 1990's to round weight quotas, but still reflect the same poundage of delivered fish. As mentioned earlier, the dividing line between the two quotas on the lake has not moved since its inception in 1951.

Commercial harvests from 1990 to 2005 have averaged 61,940 kg annually for the Precambrian area (Figure 15). This is a decrease from the 77,500 kg harvested between 1942 and 1990 as reported in Liaw (1993) (Appendix 2). Walleye has accounted for 35% of the total harvest on average, whitefish 7% and pike 34%. Suckers and other species made up the remaining 24%. This is a decrease from the previous period as reported by Liaw (1993) with respect to walleye and whitefish, and an increase in pike and suckers.

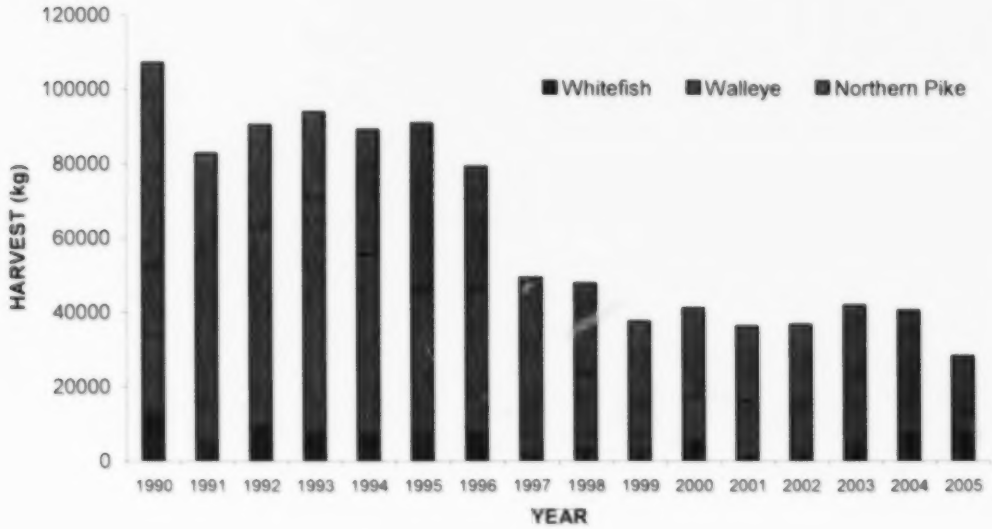

Figure 15. Commercial production history from the Precambrian area of Deschambault Lake, 1990-2005.

It should be noted however that the focus of the fishery in the early years was on whitefish, which skews the data to that species as noted by Liaw (1993). Since 1994, the deliveries of walleye from Deschambault Lake have decreased annually.

For the period 1990-2005, average landings from Ballantyne Bay have increased considerably to 93,541 kg (Figure 16) from the 70,400 kg for 1965-1990 as reported in Liaw (1990) (Appendix 3). Walleye accounted for an average of 61% of the total catch, whitefish 0.7%, pike 21%, suckers 16%. The contribution of walleye and northern pike to the catch has decreased slightly compared to that reported by Liaw (1993), while whitefish decreased substantially as suckers increased.

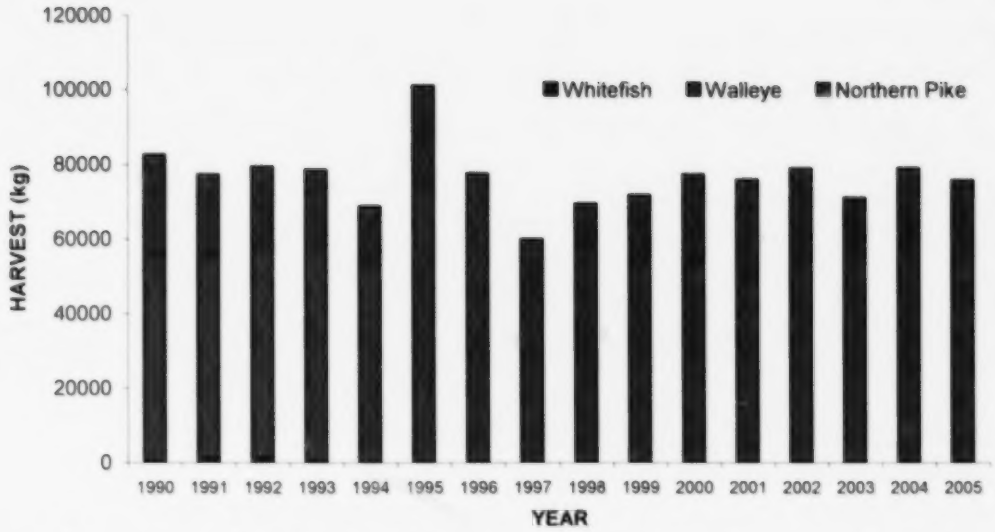

Figure 16. Commercial production history from the Ballantyne Bay area of Deschambault Lake, 1990-2005.

The Sustenance Fishery

No data is available regarding the amount or species composition of fish taken for personal consumption by residents of Deschambault Lake. The majority of the sustenance fishing occurs in the Deschambault Lake portion of the lake, close to the community. Liaw (1993) reported that sustenance harvests were probably low as a result of limited fishing activity in the area. However, an elder from the community has noted more recently that the population of Deschambault Lake is growing in number, and with it is their reliance on fish for food. The amount of sustenance harvest is probably high enough to impact on fish stocks in the area when coupled with commercial fishing in the area.

The Sport Fishery

Similar to the commercial fishing history, Liaw (1993) provides a historical background on the recreational fishery on Deschambault Lake, including estimates of harvest from the Puskwakau River fishery prior to the implementing of the spawning closure to all fishing. Estimates of recreational harvest are not available for recent years, as no creel surveys have been done.

Changes affecting the sport fishery since the last report include the elimination of the 2-day possession limit for recreational angling in 1996, as well as changes and additions to the closures on spawning areas. The dates of the closures have been extended from May 31 to June 15, and additional closures have been implemented on Ballantyne River, West Arm, Fisher Creek and Hidden Bay (Figure 1).

The sport fishery on Deschambault Lake is concentrated in the Ballantyne Bay area, with limited pressure occurring in the Deschambault Channel and East Bay. Campground and lodge guests from Northern Lights Lodge utilize the Southeast Arm on occasion. Due to the lack of islands to provide shelter on Ballantyne Bay, the summer fishery is often dictated by weather conditions on any given day. Conservation officers have indicated that fishing generally occurs on the east side of the Bay, with prevailing winds coming from the west. As such, access to the Bay is often restricted to days with low winds. During periods of high wind, anglers will often commute to nearby Limestone Lake.

The winter fishery on Ballantyne Bay started intensifying in the early 1990's and is still a popular destination for anglers today. Concern has been raised over the intensity of this fishery and the large amount of fish harvested during the winter months. Access to the winter fishery is provided through an outfitter who plows an ice road each year, or by snowmobile from another outfitter.

Liaw (1993) reported that sport-fishing harvests from Deschambault Lake were approximately 7,000 kg of walleye and 5,000 kg of northern pike; with harvests from Ballantyne Bay being approximately 33,000 kg and 14,000 kg respectively. While no estimates from recent years are available for the recreational fishery, it is assumed that the above harvests would represent a maximum. It is likely that the elimination of the 2-day possession limit has lowered sport fish harvests lakewide.

Sustainable Yields

Based on the two different harvest areas for the commercial fishery, as well as the localized pressure by the recreational fishery, sustainable yields for Deschambault Lake are calculated for Ballantyne Bay and the Precambrian area separately. The lake areas reported earlier are therefore recalculated to reflect these areas. The Ballantyne Bay commercial fishing area encompasses 31,761 hectares, while the Precambrian area is 21, 378 hectares (excluding South East Arm).

The morphoedaphic index was calculated for both of these areas based on water chemistry taken during the current survey (Appendix 1), and mean depths reported in Liaw (1993). Different TDS and mean depths were found at each of the four limnology stations (Table 2), which resulted in two different MEI values for each of the two different commercial fishing areas. The individual MEI and yield values were then multiplied by the lake area for each of the four values, which were then summed for their respective commercial fishing area to obtain a maximum sustainable yield for the lake.

Table 2. Total dissolved solids (TDS), mean depth, MEI and sustainable yield estimates for Ballantyne Bay and the Precambrian area of Deschambault Lake.

Area	Station	TDS[a]	Mean Depth	MEI[b]	Yield[c]	Lake Area[d]	MSY[e]	Total MSY
Ballantyne Bay	1	130	5.8m	22.41	5.67	27,251	154,513	181,393
	2	133	5.3m	25.09	5.96	4,510	26,880	
Precambrian Area	3	128	5.3m	24.15	5.87	7,915	46,461	111,756
	4	120	7.6m	15.79	4.85	13,463	65,295	

[a] TDS is expressed as the sum of ions for each site, averaged over the summer

[b] Morphoedaphic index = TDS / mean depth

[c] Yield = $1.4(MEI)^{0.45}$ expressed as kg/ha/yr

[d] Lake area expressed in hectares

[e] MSY= Maximum Sustainable Yield = Yield • lake area expressed as kg

Debate exists over the appropriate way to partition yield estimates from the MEI (OMNR, 1982). Allocating 100% of the yield increases the potential for overexploitation, particularly in situations where harvest by one user group is not controlled. Values of 28%, 24%, and

25% of the total yield are recommended for walleye, northern pike, and whitefish respectively (OMNR, 1982). Based on the values calculated above, the potential yields are shown in Table 3. Another method of partitioning potential yield is by weight in test net catches. For 2004, pike contributed 53.4% of the total gamefish weight, with walleye and whitefish contributing 43.4% and 3.2%, lakewide. When assessed by commercial fishing area, the Precambrian area catches were dominated by pike (74.4%) while walleye was the most plentiful by weight in Ballantyne Bay (54.1%). Potential yields for this method are shown by commercial fishing area as well for comparison, as are yields calculated from SE's rule of thumb of 0.75 kg/ha/yr for walleye and pike.

Table 3. Estimates of sustainable yield for walleye and northern pike for Ballantyne Bay and the Precambrian area of Deschambault Lake based on MEI.

Area	Species	SPOF[a]	Yield by Weight	Rule of thumb
Ballantyne Bay	Walleye	51,046 kg	98,043 kg	23,820 kg
	Pike	43,754 kg	82,679 kg	23,820 kg
	Whitefish	45,577 kg	671 kg	31,761 kg
Precambrian Area	Walleye	31,006 kg	16,540 kg	16,033 kg
	Pike	26,577 kg	83,146 kg	16,033 kg
	Whitefish	27,684 kg	12,070 kg	21,378 kg

[a] SPOF = Strategic Plan for Ontario Fisheries (OMNR, 1982)

As mentioned earlier, the harvests by all users on Deschambault Lake are not known at this time, with the exception of the commercial fishery. Liaw (1993) estimated sport fish harvests to be 7,000 kg walleye and 5,000 kg of northern pike from the Precambrian area, and 33,000 kg walleye and 14,000 kg pike from Ballantyne Bay. Assuming harvests have not changed considerably in recent years by recreational anglers, total harvest (with the exception of sustenance fishing) can be estimated for the two areas of the lake (Table 4).

Table 4. Estimated harvest of gamefish from Ballantyne Bay and the Precambrian area of Deschambault Lake, 2004 for the commercial and recreational fisheries.

Area	Species	Commercial Fishery	Recreational Fishery[a]	Total
Ballantyne Bay	Walleye	58,069	33,000	91,069
	Pike	20,344	14,000	34,344
	Whitefish	743	0	743
Precambrian area	Walleye	9,757	7,000	16,757
	Pike	23,974	5,000	28,974
	Whitefish	6,734	0	6,734

[a] Whitefish harvests by the recreational fishery are not known however they are considered to be negligible

Discussion

The limnology of Deschambault Lake has changed little from the previous survey in 1991 (Liaw, 1993). A thermocline developed in the East Bay by August, with evidence of oxygen depletion occurring. Of the stations in the Channel and Ballantyne Bay, no persistent thermocline was evident, most likely due to constant mixing by wind and wave action. Maximum temperatures approached 20.0°C in July, similar to those seen in the previous survey. Secchi disk readings have also changed little. Based on the observations taken, the lake is considered to be mesotrophic, with Ballantyne Bay being near the upper end of the scale and Deschambault Lake being near the lower end.

Similar to results from the previous survey, changes in the species composition of the fish community in Deschambault Lake were seen between survey years. Increases in the abundance of pike, whitefish, white sucker, and yellow perch were seen lake-wide, with decreases in walleye and cisco. When analyzed by commercial fishing area, abundance of fish species shows local effects that are different than those seen lake-wide. In Ballantyne Bay, walleye and yellow perch abundance decreased while northern pike increased. Little change was seen in whitefish, white sucker, and cisco. In Deschambault Lake, walleye, northern pike and cisco abundance decreased while whitefish, white sucker, and yellow perch increased.

Caution must be taken in interpreting relative abundance of fish species in this and other studies when the time between studies is large. At best, the information gathered in such surveys provides a "snap-shot" of the fish community at that particular time. Trends cannot be determined when thirteen years separate the study years. Effects of strong year classes prior to the survey can influence catch rates and abundance, especially when they become fully recruited to the gear. Regular monitoring of the fish resource will help in detecting trends over time in large waterbodies such as Deschambault Lake.

Despite the decrease in walleye abundance in the lake, population indices show signs of stability. Fish of all length classes were found in Ballantyne Bay while those from the Precambrian area were only missing one length class. It should be noted however, that of those walleye from the Precambrian area, only two were from East Bay with the remainder being caught in the South East Arm and the Channel. Typical indices of changes in populations due to exploitation such as length-weight relationships have not changed since the previous survey.

Similar results are seen for northern pike as for walleye in the two areas of the lake. In both areas, length frequency indicates a wide range of sizes present, while length-weight relationships have changed little. Age analysis confirms this with a good range of ages present. Length at age has decreased since the previous survey, possibly indicating a response to their increased abundance. Whitefish are showing signs of recovery following years of heavy exploitation, particularly in the Precambrian area.

Overall lake harvests are not known at this time due to lack of information on the recreational angling (including outfitting) and the sustenance fishery. Commercial fishing harvests are the only long-term data available for this lake. Analysis of commercial landings requires caution due to variability in effort that may not accurately reflect the true state of the fish population. Liaw (1993) reported a significant negative correlation between the number of licences sold and the harvest of walleye for both commercial fishing areas of the lake. From this he concluded that the fishery has "already reached its maximum capacity and may be in danger of experiencing continuous decline." It must be noted however, that in a fishery

with a fixed quota the more licences that are sold (and assumed to be fished), the catch per unit effort, expressed as number of kilograms per licence, will usually decrease. As such, this analysis may not be relevant in such cases. In fisheries where the number of licences sold has a maximum (i.e. limited entry), this analysis may be a more useful tool.

In the case of Deschambault Lake, commercial records indicate there are several types of commercial fishers present; those that fish intensively throughout the season (as reflected in number of deliveries and total weight by individual fisher), those that do not fish intensively but do deliver an "average" amount of fish, and those that only make one or two deliveries throughout the season. Due to this variability in effort by the participants, it is difficult to confidently draw conclusions based on commercial fishing records alone. To detect long-term trends in the data, the level of effort each year would need to be equal, or close to it. Based on the varied number of licences sold each year for the two commercial fishing areas, the level of effort, or intensity, cannot be compared.

Based on commercial landings, as well as test netting data, it can be said with some certainty that the walleye population in the northern portion of the lake (the Precambrian area) has declined. Liaw (1993) suggested that the commercial quota for walleye in this area is within the 95% confidence interval for MSY, however, the proximity to major spawning grounds may play a role in the abundance and distribution of walleye in the lake. Given the lack of major spawning areas in the Precambrian area, the walleye are at greater risk to overharvest, as has probably happened based on commercial records. The more suitable habitat and closer proximity to major spawning areas in Ballantyne Bay has probably prevented this area from experiencing the same declines seen in the north.

Walleye harvests from the commercial and recreational fisheries in Ballantyne Bay in 2004 are estimated at about 91,000 kg, which is higher than recommended harvest levels by SPOF (OMNR, 1982) and the Rule of Thumb estimates. Northern pike harvests from Ballantyne Bay are estimated at over 34,000 kg, which is less than the SPOF recommendation. In the Precambrian area, walleye harvests of almost 17,000 kg are less than SPOF recommendations, however the commercial quota greatly exceeds it. Northern pike harvests

from this area exceed both SPOF and Rule of Thumb estimators at almost 29,000 kg.

Conclusions

1. There have been no major changes to the physical or chemical parameters of Deschambault Lake since the last survey
2. Test netting results indicate the same number of species present in the lake through all three surveys, however there have been changes in the relative abundance of these species. Lake wide decreases were seen in walleye and cisco, while northern pike, whitefish, white sucker and yellow perch increased.
3. Walleye numbers have dropped in test net catches, however other indices of population stability have not changed since the previous survey.
4. Northern pike have shown little change since the last survey, while lake whitefish appear to be increasing.
5. Commercial landings from the Precambrian area have averaged 29,850 kg of walleye, 26,655 kg of pike and 5,434 kg of whitefish since 1990/91. A steady decrease in walleye harvests has been seen since the 1994 fishing season.
6. The commercial fishery harvested on average 56,275 kg of walleye, 19,746 kg of pike and 609 kg of whitefish since 1990/91 from Ballantyne Bay.
7. Estimates of sport fish harvests are not available since the previous report. It can be assumed that current harvests have not exceeded those in the previous report because of the reduced possession limits implemented province wide in 1996.

Management Recommendations

1. No changes to the recreational or commercial fisheries are recommended at this time.
2. Maintain current area fishing closures on spawning runs. The spawning closures that have been implemented on the major spawning runs have been instrumental in sustaining the walleye fishery on Deschambault Lake given the high amount of harvests by all users. Continued protection of these areas is vital to ensure long-term sustainability of the fishery.

3. The recreational and sustenance harvests from the lake should be determined to provide a more accurate estimate of total lake harvest.
4. Any management actions to reduce the recreational harvest on Deschambault Lake will result in a shift in fishing pressure to other lakes in the area, which are already intensively fished. Potential economic losses to outfitters on Deschambault Lake may also occur due to a loss in clientele. Regional management actions affecting all lakes in the area will be needed to help in buffering this anticipated response.
5. The lake should be re-examined every five to seven years to determine trends in the fishery.

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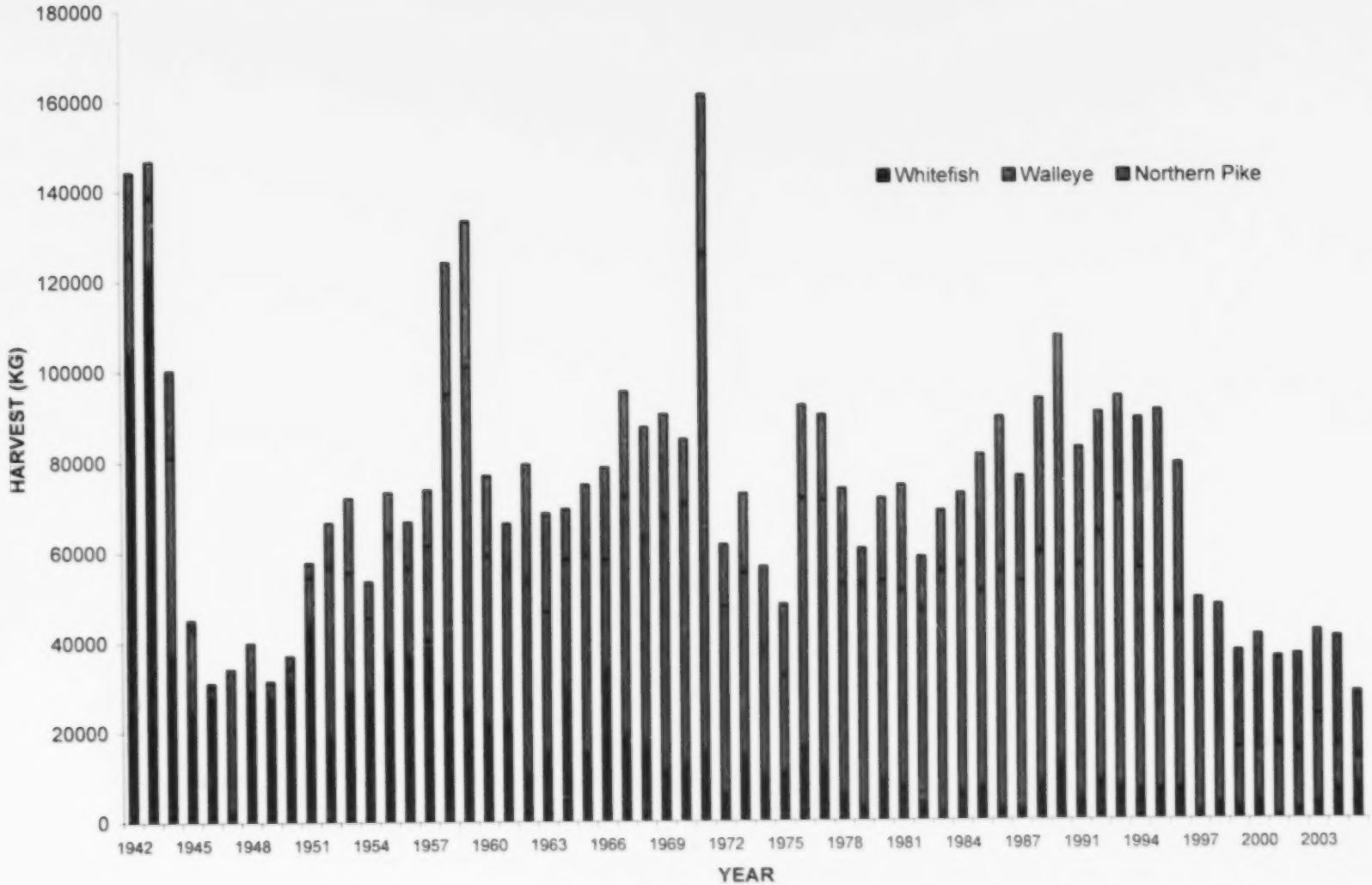
Appendix 1 Limnology from the four stations in Deschambault Lake.

Date	Site#	Rep#	Secchi	EC Chl-a	EC TP	EC TN	EC POC	EC PON	EC TDN	EC Colour	EC NO3-N	EC NH3-N	EC PO4-P	EC TDP	PL T-Alk	PL HCO	PL Diss Ca	PL DOC	PL Cl	PL HARDNESS TOTAL (CALCD.) C	PL Diss Mg	PL Mn	PL Fe	PL NO3 &	PL PH	TP	PL SODIUM DISSOLVED	Potassium	PL SPECIFIC CONDUCTANCE	PL SULPHATE	Si	Sum of Ions	Carbonate
			(m)	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	mg/l												mg/l	mg/l	mg/l
8-Jun-04	1	1	2.3	0.002	0.023	0.465	0.478	0.075	0.39		<0.01		<0.002	0.005	81	99	21	9	2.1	81	6.9	0.036	0.057	<0.04	7.91	0.02	4.1	1.6	174	2.9	1.7	138	<1
8-Jun-04	1	2	2.3	0.002	0.023																												
8-Jun-04	2	1	1.8	0.007	0.027	0.503	0.648	0.106	0.397		<0.01		<0.002	0.006	81	99	20	9.2	2	78	6.8	0.044	0.074	<0.04	7.87	0.02	4	1.5	174	2.5	1.8	136	<1
8-Jun-04	2	2	1.8	0.006	0.026																												
8-Jun-04	3	1	1.7	0.006	0.032	0.499	0.976	0.139	0.36		<0.01		<0.002	0.006	69	84	18	8.4	1.9	70	6.1	0.017	0.048	<0.04	7.99	0.01	3.8	1.4	155	2.7	0.62	118	<1
8-Jun-04	3	2	1.7	0.006	0.031																												
8-Jun-04	4	1	2.7	0.006	0.029	0.52	0.74	0.116	0.404		<0.01		<0.002	0.007	72	88	18	9.5	1.9	70	6.2	0.034	0.065	<0.04	7.8	0.02	3.9	1.6	160	2.7	1.2	122	<1
8-Jun-04	4	2	2.7	0.005	0.029																												
8-Jun-04	4	1	2.7		0.043	0.555	0.673	0.133	0.422		<0.01		0.003	0.01																			
8-Jun-04	4	2	2.7		0.042																												
13-Jul-04	1	1	1.7	0.011	0.024	0.592	0.766	0.139	0.453	10	<0.01	0.012	<0.002	0.006	76	93	19	7.3	2.3	74	6.4	0.027	0.053	<0.04	8.27	<0.01	3.7	1.4	164	2.4	1.3	128	<1
13-Jul-04	1	1	1.7		0.045	0.535	0.581	0.089	0.446	10	<0.01	0.037	0.005	0.014																			
13-Jul-04	2	1	1.5	0.012	0.024	0.614	1.04	0.183	0.431	10	<0.01	0.012	<0.002	0.007																			
13-Jul-04	2	1	1.5		0.061	0.601	0.625	0.077	0.524		<0.01	0.135	0.012	0.022																			
13-Jul-04	3	1	1.8	0.007	0.022	0.586	0.955	0.148	0.418	8	<0.01	0.014	<0.002	0.005	74	90	19	9.2	2.2	74	6.4	0.05	0.046	<0.04	8.03	<0.01	3.7	1.4	162	2.7	0.96	125	<1
13-Jul-04	4	1	3.5	0.003	0.023	0.489	0.438	0.065	0.424	5	<0.01	0.016	<0.002	0.011	69	84	18	8.7	2	70	6.1	0.032	0.036	<0.04	7.88	0.01	3.7	1.4	155	2.9	0.77	118	<1
13-Jul-04	4	1	3.5		0.023	0.463	0.325	0.04	0.423		<0.01	0.032	0.004	0.011																			
13-Jul-04	4	1	3.5		0.053	0.539	0.439	0.038	0.501		0.011	0.107	0.015	0.022	71	87	18	8.6	2	70	6.1	0.17	0.11	<0.04	7.52	0.04	3.7	1.5	158	2.7	1.7	121	<1
11-Aug-04	1	1	1.55	0.026	0.038	0.651	0.947	0.162	0.489	20	<0.01	0.038	<0.002	0.009	77	94	20	9.2	2.6	77	6.7	0.038	0.051	0.18	8.01	0.02	3.9	1.5	169	2.6	2.2	131	<1
11-Aug-04	1	2	1.55	0.027																													
11-Aug-04	1	1	1.55		0.042	0.713	1.28	0.222	0.491	25	<0.01	0.048	<0.002	0.008																			
11-Aug-04	2	1	1.45	0.027	0.044	0.697	1.33	0.241	0.456	20	<0.01	0.033	<0.002	0.008	77	94	20	9.7	2.1	77	6.6	0.056	0.096	0.07	8	0.03	3.9	1.5	170	2.5	2.5	131	<1
11-Aug-04	2	1	1.45		0.042	0.685	1.17	0.207	0.478	20	0.01	0.053	<0.002	0.008																			
11-Aug-04	3	1	1.4	0.016	0.044	0.699	2.02	0.288	0.411	25	<0.01	0.015	<0.002	0.007	77	94	20	9.4	2	77	6.6	0.081	0.11	<0.04	7.66	0.02	3.9	1.5	168	2.5	1.7	131	<1
11-Aug-04	4	1	2.1	0.013	0.035	0.556	0.887	0.145	0.411	10	<0.01	0.016	<0.002	0.01	72	88	18	8.8	2	70	6.2	0.016	0.011	0.04	7.73	[illegible]	3.8	1.5	160	2.8	1.2	122	<1
11-Aug-04	4	2	2.1	0.011																													
11-Aug-04	4	1	2.1		0.033	0.57	0.868	0.153	0.417	10	<0.01	0.019	<0.002	0.007																			
11-Aug-04	4	1	2.1		0.113	0.864	0.423	0.044	0.82	5	0.01	0.348	0.048	0.057	8	10	18	8.6	1.8	71	6.3	0.77	0.3	0.04	6.51	0.14	3.8	1.6	74	2.3	3.9	44	<1

Appendix 2. Commercial harvests from the Precambrian area of Deschambault Lake, 1942-2005



Appendix 3. Commercial harvest from Ballantyne Bay of Deschambault Lake, 1965-2005.